

## Claims

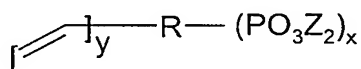
1. Proton-conducting electrolyte membrane obtainable by a method consisting of the following steps:

- 5 A) expanding a polymer film with a liquid that contains a vinyl-containing phosphonic acid, and  
 B) polymerisation of the vinyl-containing phosphonic acid present in the liquid introduced in step A), characterised in that the intrinsic conductivity of the inventive membrane at temperatures of 160°C is at least 0.001 S/cm.

10 2. Membrane according to claim 1, characterised in that the film used in step A) has an expansion of at least 3% in the liquid containing vinyl-containing phosphonic acid.

15 3. Membrane according to claim 1, characterised in that the polymers used in step A) are high-temperature stable polymers which contain at least one nitrogen, oxygen and/or sulphur atom in one or a number of recurring units.

20 4. Membrane according to claim 1, characterised in that the liquid containing the vinyl-containing phosphonic acid contains compounds of the formula



in which

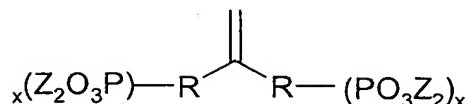
25 R denotes a bond, a C1-C15-alkyl group, C1-C15-alkoxy group, ethyleneoxy group or C5-C20-aryl or heteroaryl group, and the abovementioned radicals for their parts can be substituted by halogen, -OH, COOZ, -CN, NZ<sub>2</sub>

30 Z independently of each other denotes hydrogen, a C1-C15-alkyl group, C1-C15-alkoxy group, ethyleneoxy group or C5-C20-aryl or heteroaryl group, and the abovementioned radicals for their parts can be substituted by halogen, -OH, COOZ, -CN, NZ<sub>2</sub> and

x denotes a whole number 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10

y denotes a whole number 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10

and/or the formula

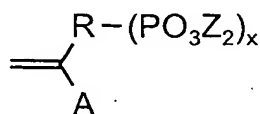


in which

R denotes a bond, a C1-C15-alkyl group, C1-C15-alkoxy group, ethyleneoxy group or C5-C20-aryl or heteroaryl group, and the abovementioned radicals for their parts can be substituted by halogen, -OH, COOZ, -CN, NZ<sub>2</sub>

Z independently of each other denotes hydrogen, a C1-C15-alkyl group, C1-C15-alkoxy group, ethyleneoxy group or C5-C20-aryl or heteroaryl group, and the abovementioned radicals for their parts can be substituted by halogen, -OH, COOZ, -CN, NZ<sub>2</sub> and

x denotes a whole number 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10, and/or the formula



in which

A represents a group of formula COOR<sup>2</sup>, CN, CONR<sup>2</sup><sub>2</sub>, OR<sup>2</sup> and/or R<sup>2</sup>, in which R<sup>2</sup> denotes hydrogen, a C1-C15-alkyl group, C1-C15-alkoxy group, ethyleneoxy group or C5-C20-aryl or heteroaryl group, and the abovementioned radicals for their parts can be substituted by halogen, -OH, COOZ, -CN, NZ<sub>2</sub>,

R denotes a bond, a bivalent C1-C15-alkylene group, bivalent C1-C15-alkyleneoxy group, for example an ethyleneoxy group or bivalent C5-C20-aryl or heteroaryl group, and the abovementioned radicals for their parts can be substituted by halogen, -OH, COOZ, -CN, NZ<sub>2</sub>,

Z independently each other denotes hydrogen, a C1-C15-alkyl group, C1-C15-alkoxy group, ethyleneoxy group or C5-C20-aryl or heteroaryl group, and the abovementioned radicals for their parts can be substituted by halogen, -OH, COOZ, -CN, NZ<sub>2</sub> and

x denotes a whole number 1, 2, 3, 4, 5, 6, 7, 8, 9 or 10,

5. Membrane according to claim 1, characterised in that the liquid containing the vinyl-containing phosphonic acid contains monomers that are capable of cross-linking.

6. Membrane according to claim 1, characterised in that the liquid containing the vinyl-containing phosphonic acid contains at least one substance that is capable of radical formation.
- 5 7. Membrane according to claim 1, characterised in that the polymerisation according to step C) takes place by irradiation with IR or NIR light, UV light,  $\beta$ -,  $\gamma$ - and/or electron radiation.
- 10 8. Membrane according to claim 1, characterised in that the membrane has an intrinsic conductivity of at least 0.001 S/cm.
- 15 9. Membrane according to claim 1, characterised in that the membrane contains between 0.5 and 97% by weight of polymer and between 99.5 and 3% by weight polyvinylphosphonic acid.
- 20 10. Membrane according to claim 1, characterised in that the membrane has a layer containing a catalytically active component.
11. Membrane-electrode assembly containing at least an electrode and at least a membrane according to one or more of claims 1 to 10.
- 25 12. Fuel cell containing one or more membrane-electrode assemblies according to claim 11 and/or one or more membranes according to any of claims 1 to 10.